This experiment I have repeated since reading Wiesner's book, and have found the results to be the same. The conclusion is inevitable and is in this case absolutely destructive of Wiesner's theory of "Zugwachsthum."

This theory he grounds on the following experiment (p. 69), in which he makes use of Sachs's method of observing heliotropism:—Seedlings growing in small vessels are fixed in the place of the minute-hand of a large clock, so that each seedling is at right angles to the axis of rotation, and rotates like the hand of the clock; they are then illuminated by light which is parallel to the axis of rotation, and therefore each seedling has one side constantly illuminated by light striking it at right angles. Owing to the constant rotation the effect of weight is eliminated, and thus any curvature which occurs cannot be due to "Zugwachsthum." Wiesner states that whereas the seedlings on the klinostat (Sachs' name for this instrument), were only curved in their upper parts; plants growing normally without being subjected to rotation were curved down to the ground. This seems at first a conclusive argument against our view, but I shall show that in the case of two plants, cabbage and Phalaris, it is not so.

We expressly stated (p. 479) that our experiments on cabbages were made on young seedlings "about half an inch or rather less in height," because when the plants have grown to an inch and upwards in height the lower part ceases to bend heliotropically. Now Wiesner's experiments were made confessedly on seedlings whose lower part was growing slowly, and which were therefore probably older than those which we employed for our experiments. When Wiesner made his rotating experiment with *young* cabbage seedlings they became curved down to the ground. This proves that the curvature which occurs near the ground in young cabbage seedlings is not due to weight; and this is the very curvature which we have shown not to occur unless the upper part is illuminated. I do not attempt to explain Wiesner's experiments on old cabbage seedlings, but those made with young ones are alone of importance for us, and they are conclusively on our side.

With regard to Phalaris I regret that I cannot confirm Wiesner's results, who states that these seedlings behaved like the dicotyledons experimented on; *i.e.* that when grown on the rotating apparatus they do not become bent down to the ground. I have experimented with young seedlings such as we should have used for the experiments on transmission of the light-stimulus, and found that many of them became well bent down to the ground. But it should be remarked that in some cases a certain amount of difference in this respect was observable between the plants on the klinostat and normal ones.

FRANCIS DARWIN

(*To be continued.*)

OUR BOOK SHELF

Through Siberia. By Henry Lansdell. Two volumes, with illustrations and maps. (London: Sampson Low and Co., 1882.)

IT is obvious that much scientific information cannot be expected from a traveller who was, to use his own expression, "flying across Europe and Asia," and who crossed Siberia from Ekaterinburg, in the Ural Mountains, to Tobolsk in the North, Barnaoul in the Altai, and Nikolaevsk on the Pacific, a distance of 6600 miles, in seventy-eight days, and whose aim was, during this very short time, to investigate the situation of Russian prisons. The author has, however, supplemented his own somewhat superficial observations by information obtained from good sources. The book is provided with many illustrations, partly taken from other works (without quoting the source from which they are taken), and partly from new photographs. These are sometimes very good, but sometimes they convey quite false ideas, as, for instance, the photograph of a "Buriat girl," who obviously is a metis, having very little in common with true Buriats.

P. K.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Limulus

IN a criticism published in the *American Naturalist* for April, 1882, on Prof. Ray Lankester's recent most able memoir, entitled "Limulus an Arachnid," Mr. A. S. Packard, whose most important researches on Limulus are familiar to all zoologists, and to whose courtesy I am indebted for a copy of his criticism, after stating other grounds which lead him to differ in opinion from Prof. Lankester as to the close relationship of the King Crab and the Scorpion, quotes in his final paragraphs extracts from published letters written by my late lamented friend and shipmate, R. von Willemoes-Suhm, from on board H.M.S. *Challenger*, at the Phillipine Islands and Japan in February and May, 1875, concerning certain Arthropod embryos which he had had under observation at Zamboangan, and which he then supposed to be the larvæ of *Limulus rotundicauda*. As Von Suhm and I worked together for more than two years daily with our microscopes within two feet of one another, we naturally discussed all that we did and observed in common, and we frequently talked about these supposed Limulus embryos, and looked at them together. It is as well, therefore, since the statements concerning them are being made use of to assist in disproving the position assumed by Prof. E. van Beneden, Prof. Lankester, and others as to the Arachnid nature of Limulus, a position of the strength of which I am myself persuaded, that I should state in print, that long before his death Von Willemoes-Suhm was completely convinced that he had been misled as to the larvæ, and told me that he felt sure they were not those of Limulus at all, but belonged to a Cirrhiped of some sort. I some time ago told my friend, Prof. E. van Beneden, who inquired on the matter, that such was Von Suhm's final conclusion. And I also long ago told Prof. Lankester, and this is no doubt the reason why no reference to Von Suhm's letters was made by the latter in his memoir.

It must be remembered that the only evidence in favour of Von Suhm's Nauplius larvæ being those of Limulus, lay in their general appearance, which simulated to some extent that of an adult Limulus, and in the fact that they were caught with the tow-net in Zamboangan harbour, a locality at which *Limulus rotundicauda* occurs.

H. N. MOSELEY

Oxford, April 15

Silurian Fossils in the North-West Highlands

THE publication of Dr. Heddle's geological and mineralogical map of Sutherland, which was noticed in NATURE, vol. xxv. p. 526, calls to mind some curious points with reference to that region—points on which we should like to have some further and more definite information.

Dr. Heddle quite acquiesces in the general accuracy of the stratigraphical conclusions arrived at by Murchison and his colleagues, and, as may be gathered both from his map and writings, has seen no cause whatever to induce him to believe either in the great fault of Prof. Nicol, or in the unconformity alleged by Dr. Hicks to exist in the adjacent county.

It would seem, therefore, that the chief bone of contention, viz. the age of the great mass of Upper Gneiss, which extends over the central and eastern parts of Sutherland, had been finally and irrevocably decided to be Silurian, notwithstanding the misgivings of the anti-metamorphic school.

There is just one more chance of avoiding the dreaded conclusion, and this "last phase of dissent" has appeared in the form of Dr. Heddle's map and accompanying papers, published in the *Mineralogical Magazine* for 1881. This last phase of dissent so far differs from the others, in that it is not based on foregone conclusions, and does no violence to stratigraphical facts, but is the natural and thoroughly unbiassed outcome of a long series of observations in the field and in the laboratory.

The question now to be solved, stated in the fewest possible words, amounts to this: What is the relation between the fossiliferous limestone of Durness, a limited patch on the north coast of Scotland, and the quartzo-dolomitic series, which, commencing at Loch Erribol, stretches southwards through the counties of Sutherland and Ross in varying phases of development for fully one hundred miles?

If this quartzo-dolomitic series is of the same age, or approximately of the same age, as the Durness limestone, which contains Lower Silurian fossils; then the last phase of dissent is knocked on the head, and henceforth orthodoxy reigns supreme. Aye, there's the rub; and this brings me to the point.

The palæontological facts bearing on this subject require to be re-stated with more confirmatory evidence. We can hardly be satisfied with such vague things as Serpulites, Fucoids, and the like; what is required in the present case is some clear and indisputable evidence that Lower Silurian fossils have been found in any part of the quartzo-dolomitic series away from the Durness basin.

Placing the most implicit reliance formerly in the statements of Murchison, that Orthoceratites had been detected by Mr. Peach and himself in Assynt, and further, that *Orthoceras* had been found in the upper quartz rock of Erribol, the fragment having been identified by Salter as *Orthoceras* (*Cameroceras*) *Brongniartii* (*Q. J. G. S.*, vol. xvi. p. 230), I have felt a little sceptical on the subject lately. Not that one would venture to doubt the perfect good faith of Murchison and his colleagues for a single instant. But it is possible to make mistakes in such matters, and we would wish to see something like a renewal of these alleged discoveries.

Besides it is well known that several eager and experienced searchers have paid visits to the North-west of late years, and, although they found very curious and enigmatical markings in the quartzite series, neither Prof. Blake nor Dr. Callaway, for instance, have succeeded in obtaining a form which could be unmistakably regarded as a Silurian fossil. Moreover, Prof. Blake, who was engaged about the year 1878 in making investigations for his great work on the British fossil Cephalopoda, endeavoured to trace the history of these alleged discoveries, but without success.

Those who may be regarded as Murchison's heirs and successors, must see how vital this point is, and we look to them, not to be content with hunting up old statements as to the discovery of recognisable Silurian fossils, but to afford us the means of satisfying ourselves, beyond the possibility of a doubt, that Silurian fossils do occur in the quartzo-dolomitic series. When this is done, all controversy on the "North-west Succession" should, in the absence of any startling and unexpected discovery, cease; but, until it is done, "the last phase of dissent" will continue to be regarded as a possible explanation by those who are not wedded to any theory, but who require that no link in the chain of evidence shall be wanting.

W. H. HUDLESTON

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Magnetic Storm

IT may interest some of your readers to know that a magnetic storm of unusual intensity raged from about midnight of Sunday the 16th to midnight of the 17th. The photographic records are only now being developed, so time will not permit of a detailed account being furnished for this week's number.

We observe a tremendous spot which appeared on the sun's disc first on the 13th, is now rapidly approaching the central meridian, and a group observed on Saturday a little in advance of it, appears to have undergone considerable change in the interval. Possibly those observers furnished with better appliances than we have at our disposal will be able to give fuller information respecting what has taken place on the solar disc during the last few days.

G. M. WHIPPLE

Kew Observatory, Richmond, Surrey, April 18

Sea-shore Alluvion—Dungeness or Denge-nesse

As Lambarde points out, lying in Walland and Denge marshes, the "neshe" or Saxon "nesse," a "nebbe" or "nose" of land extending into the sea derived its name from the last marsh—Somner terms it "Stone End"—"Lapis appositus in ultimo terræ." Grunville Collins, in 1693, says, "You may keep within nine or ten fathom of it close to the shoar." Westward of Folkestone great changes have taken place in the condition of the old havens, due to the early accretion and continuous extension up to the present time of this remarkable spit of shingle formed to windward of a tidal estuary. The whole area at the present time between the Royal Military Canal which runs from Sandgate west of Folkestone to Rye, and which forms the base of the Ness, twenty miles in length, and southward to the sea exhibits parallel series of curves running in undulating waves, displaying the periodical accessions to the coast very similar to the annular rings in timber; the surface of which, landward, is gradually brought into cultivation. Lydd, at a comparatively recent period a port, is now three or four miles from the sea. Two natural roadsteads are formed by this spit, in which, dependent on the quarter from which the wind prevails, seven to eight hundred vessels may be seen riding at anchor, lying within two or three miles of Lighthouse Point, the extremity of the Ness.

Numerous projects have from time to time been brought forward for the formation of a harbour of refuge, by running out a pier from the extremity of Dungeness; but having reference to the large amount of speculation as to its origin and progress, the Legislature have wisely hitherto turned a deaf ear to any tampering with a breakwater of nature's forming, affording, as it does, two excellent havens of refuge under certain conditions of weather, for all these shingle nesses possess the remarkable property of creeping across, and having deep water at their extremities.

It has been assumed with some plausibility that the meeting of the tides (which, however, is much further eastward) has influenced its origin. A formation of this description is, however, very little influenced by the tides, and similar shingle spits are found tailing round and across the outfalls of tidal rivers of great velocity, and a similar spit—Langley Point, has formed to the westward under Beachy Head, east of Eastbourne, where there is no such assumed meeting of the tides, and the origin of which may also be traced to a now extinct tidal harbour (Pevensey) to leeward of it.

On the east coast, masses of shingle form similar nesses, such as Landguard Point, inclosing Harwich Harbour, Orfordness, inclosing Orford Haven, and others.

The average progress of Dungeness, in a south-eastern direction has amounted to six yards per annum, and reaching over certain periods an average of eight yards per annum has been attained; this, however, is local, and accompanied by periodical wasting away along the curved bays east and west of Lighthouse Point. This action may be seen in Rye bay, where there is less shingle and more sand by patches of diluvial peat cropping up through the foreshore.

A determinate south-east movement of the extremity of the Ness results from these variations in outline as may be seen on reference to the Ordnance Sheet of H.M. Geological Survey, the position of the old "fulls" to the westward being laid down thereon, indicating plainly the eastern leeward movement.

The following extracts from various hydrographic authorities show the high estimation held for this natural breakwater and its attendant harbours of refuge by naval men.

Norie in his "British Channel Pilot," says:

. . . "You may round this point in 10, 11, or 12 fathoms. The strongest tide runs in 15 fathoms. Ships bound down channel, and meeting here with westerly winds, may anchor to the eastward of the '*Ness*' in 10 or 12 fathoms. . . . You may also anchor to the westward of the 'Ness,' with north-east winds, in 7 or 8 fathoms."

Capt. Martin White, R.N., in his Sailing Directions for the English Channel, says:—

"The West Bay of Dungeness affords good anchorage against north-easterly winds, *and is certainly preferable to Dover Road.*"

"When the wind is between north and by east and west and